UNITED
NATIONS

ST

Secretariat

Distr.
GENERAL

ST/SG/AC.10/C.3/1998/70
16 April 1998

Original: ENGLISH

COMMITTEE OF EXPERTS ON THE TRANSPORT OF DANGEROUS GOODS

Sub-Committee of Experts on the Transport of Dangerous Goods
(Fifteenth session,
Geneva, 29 June-10 July 1998,
agenda item 6 (a))

EXPLOSIVES (CLASS 1)

Kinetic energy criteria in the 6(c) test as assessed by the distance - Mass relation

Transmitted by the Expert from the Netherlands

1. The UN Working Group tasked with clarifying the 6(c) tests met in February 1998 in Washington and discussed, amongst others, the matter of projection hazard.
On the one hand there was consensus to use 20 J as the border line between 1.2 and 1.4 classification, when assessed with perforation of the witness screens. On the other hand, it was felt that it was not suitable to depend on the witness screens alone for the classification. Both the experts from the USA and the Netherlands presented curves to represent the distance - mass relation for fragments wit 20 J and 8 Joule. When using the same starting points for the calculations the results from both countries were very similar. The curves are given in Figure 1

2. The Working Group discussed the topic of the allowable number of fragments at length, but was not able to reach consensus. It was decided to maintain the current criteria (not more than 10 metallic fragments, each with mass exceeding 25 g, are thrown more than 50 m from the edge of the packaged or unpackaged articles, or: a metallic projection with mass exceeding 150 g thrown more than 15 m from the edge of the packaged or unpackaged articles) for the time being

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Strict application of these criteria can result in the situation that 10 fragments with a mass of 150 g can be thrown at an unlimited distance and thus unlimited kinetic energy. This situation represented by the marked area in Figure 1.
The described situation leads to very strange cases where, when one fragment would "accidentally" hit a witness screen a 1.2 classification would result; while when no screens are hit a 1.4 classification is obtained. It is clear that the latter might represent a much larger hazard than a fragment with, for instance, 25 J kinetic energy.

3. It is recognised that the reluctance to use the energy curves to establish the classification is based on the desire not to change current classification, but it is also recalled that the described ambiguous situation was one of the reasons why the whole process of clarifying the 6(c) test was started.

4. The expert from the Netherlands would like to invite the experts from the various countries to reconsider this issue. There is now the chance to improve the description of the 6(c) test, a need which is felt by many competent authorities and test institutes.

5. It is recalled that the three witness screens are placed at a distance of 4 m from the edge of the packages. The surface of the hemisphere with a radius of 4 m, representing the plane through which projection can travel, is 100 m^2. The total surface of the three witness screens is 12 m^2, in total one eighth of the surface. In practice, the radius is larger than 4 m, leading to a larger total surface, say 120 m^2. Assuming a homogeneous distribution of the fragments, there is a chance on one to ten for the fragments to hit a witness screen. It would therefore be logical to accept up to ten fragments with a kinetic energy up to 20 J when not assessed by perforation of a witness screen.
Given the more incidental nature of an event for a 1.4S classification, the Netherlands expert feels that the number of ten fragments is not valid in this case. We therefore propose to follow the current practice of "any fragment...." and thus to allow none fragments with an energy exceeding 8J.

Proposal

6. It is proposed that paragraph 16.6.1.4.3, item (b) and (c) of the Manual of Tests and Criteria (as also given in Annex 1 to the report of the working group meeting) be replaced by the following text.

(b) more than 10 [metallic] fragments with a kinetic energy exceeding 20 J as assessed by the distance - mass relation given in Figure 16.6.1.1

7. Similarly, the criteria for 1.4 classification given in Annex 1 to the report of the working group on page 14, paragraph 16.6.1.4.5 are proposed to be amended by the following text

(b) no [metallic] fragments with a kinetic energy exceeding 8 J as assessed by the distance - mass relation given in Figure 16.6.1.1

(c) a projection [including those which function more than 5 m from the fire], thermal effect.....

Include Figure 2 and/or Table 1 as Figure 16.6.1.1 in the Manual of Tests and Criteria.

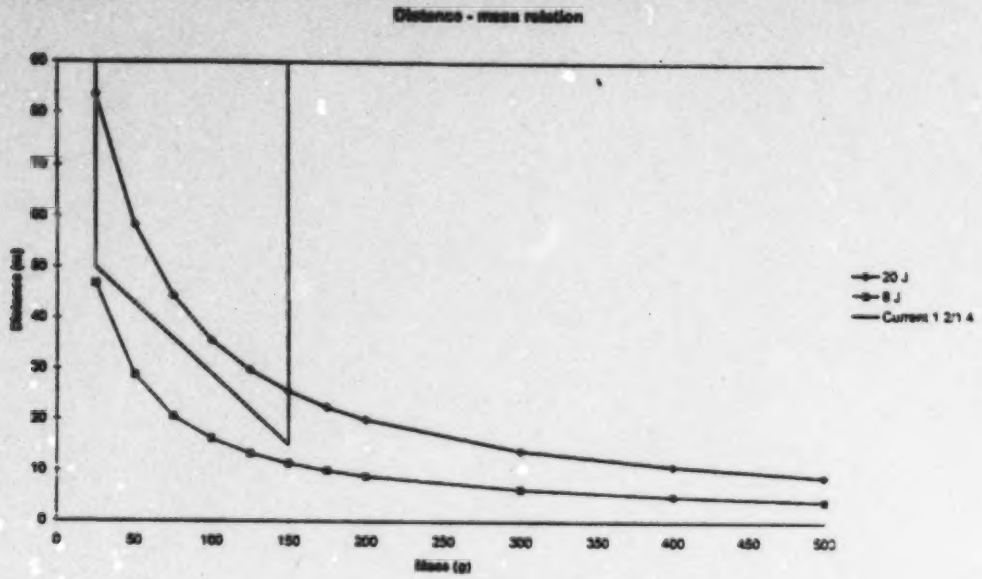

Figure 1 Distance -mass relation for fragments with a kinetic energy of 20 J and 8 J, together with the current criteria for the dividing line between 1.2 and 1.4 classification.

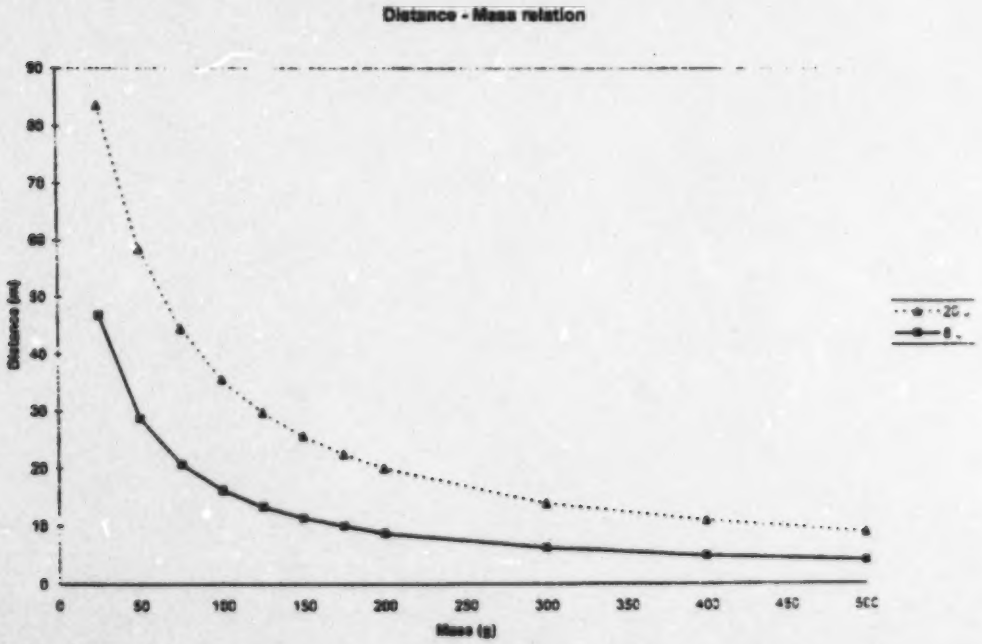

Figure 1 Distance -mass relation for fragments with a kinetic energy of 20 J and 8 J

Table 1 Distance -mass data for fragments with a kinetic energy of 20 J and 8 J

Mass	Projection distance (m)	
(g)	20 J	8 J
25	83.6	46.8
50	58.4	28.7
75	44.4	20.6
100	35.6	16.2
125	29.8	13.3
150	25.6	11.4
175	22.43	10
200	20	8.8
300	13.9	6.3
400	10.9	4.9
500	8.9	4.1